The role of sulfate-reducing bacteria in producing biosignatures in hypersaline microbial mats

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Microbial biosignatures are produced as a result of the combined metabolic activities of a community. Hypersaline microbial mats are typically dominated by oxygenic cyanobacteria; aerobic and anaerobic heterotrophic bacteria are also abundant in these mats. The tight coupling of production and consumption of oxygen, a key biosignature, results in no or little net release of this metabolite. Conversely, anaerobic processes exert an important control on gaseous biosignature production, notably methane and volatile organosufides. Especially in light of recent discoveries on Mars, indicating that liquid water may have existed in shallow hypersaline reservoirs, it is critical to understand the

dynamics between sulfate reducers and methanogens. Similar to observations in salterns in Eilat by others, we found in several natural systems that undergo salinity "cycles" a pattern of methane production that depends on the salinity within the system. The net flux of methane is determined to a large extent by the competitive interaction between sulfate reducers and methanogens. The former group of microorganisms also plays an important role in the formation of biosignatures in the rock record, markedly that of calcium carbonate. Through a similar mechanism as discussed above for gases, decoupling of aerobic and anaerobic metabolism in space and time, sulfate reducers play a key role in precipitation of carbonates. We will present field and laboratory observations in support of this. In conclusion, biosignatures clearly result from combined metabolic activity of the entire community, but our observations suggest that sulfate reductions plays a key role in the production of these.